Operating Instructions

for

F.M. DEVIATION METER

(TEST SETS DEVIATION)

Type TF 934

MARCONI Instruments Limited

ST. ALBANS · HERTFORDSHIRE · ENGLAND

EB 934
1 - 6/51.
(J 1416 - Prop)

OPERATING INSTRUCTIONS NO. EB 934

F.M. DEVIATION METER.

(TEST SETS DEVIATION)

TYPE TF 934.

check at
3 MHZ
5 KHZ
55 MV. INPUT

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Drawings: Functional Diagram.....TBI 20390
Complete Circuit.....Dng. No. 5441.

SCHEDULE OF PARTS SUPPLIED.

The complete equipment comprises the following:-

1. One Instrument Type TF 934 complete with valves and lamp as under:-

Valves: Eight: Type EF 91 - CV 138
Four: Type EB 91 - CV140
Two: Type QS90/10 - CV286 — 90V REG
Two: Type 6C4 - CV133
One: Type 6X5G - CV572
One: 6.5V, 0.3A, MES.

2. One Mains Lead.

3. One Input Cable with Terminating Unit.

4. One Instruction Book No. EB 934.

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1. DESCRIPTION.

General. The Test Set is for the determination of carrier frequency deviation at audio frequency rates. The carrier frequency range extends from 2.5 Mc/s to 10 Mc/s and from 20 Mc/s to 100 Mc/s in a total of eight bands; the deviation ranges are 0-5 kc/s, 0-25 kc/s and 0-75 kc/s. In addition to the output operating the directly calibrated deviation meter, an independently buffered outlet is provided for aural or visual monitoring.

The power pack is for 100-150V and 200-250V, 40-100 c/s.

Basic Arrangement. The carrier to be observed is heterodyned to an intermediate frequency of convenient value and the resultant band of frequencies passed through a wide-band amplifier and a limiter. The pulses of varying recurrence frequency emerging are then "counted" by an integrating system, the ultimate output being a wave of the original modulation frequency whose amplitude is strictly proportional to frequency deviation.

Measuring Circuit. The r.f. input is fed via a buffer amplifier to a frequency changer circuit comprising a local oscillator and diode mixer. The beat frequency is passed to the i.f. amplifier and thence to a stabilised limiter.

The ensuing counting circuit comprises a parallel pair of opposed diodes fed via a small capacitor and constituting a system having a time constant small compared with the period of the input. Pulses of constant amplitude but of varying recurrence frequency charge the capacitor through the first diode, discharge taking place through the second diode and its load resistance, the mean current in the latter being directly proportional to the pulse rate - and hence to the frequency of the i.f. signal. Variation of frequency due to frequency modulation produces an a.c. voltage superimposed on the d.c. component of the load voltage; the peak value of this voltage being directly proportional to peak frequency deviation, it is applied via an a.f. amplifier to a peak valve voltmeter calibrated in terms of deviation.

The deviation range switch selects the appropriate load resistance and either positive or negative deviation relative to the mean carrier may be determined by tuning the local oscillator above or below the signal frequency.

Checking Circuits. Features of the design are the inclusion of adequate setting up and checking facilities. To ensure that the local oscillator is set to produce the preferred intermediate frequency, the instrument is switched to TUNE, the d.c. component from the measuring diode then being applied directly to the indicating meter to produce a standard deflection. Similarly, to ensure that the input is adequate, the instrument is switched to CHECK INPUT; the meter then checks the level of the signal applied to the limiter.

Provision is made for checking and correcting the deviation indication. When the instrument is switched to SET DEVIATION, the circuit is interrupted after the first i.f. amplifying tube, the second i.f. tube then functioning as a crystal-controlled oscillator. At the same time, an alternating potential

is impressed on the screen of the ensuing valve which suppresses the generated frequency at alternate half-cycles of the supply frequency; this produces a test signal of constant effective deviation against which the deviation scale may be standardised by adjustment of the SET DEVIATION preset control.

A.F. Output. For general convenience in operation, and also to enable the demodulated signal to be applied to a c.r.o. if desired, the output from the a.f. amplifier is passed through an auxiliary buffer stage and brought out both to a telephone jack and to a pair of terminals.

Power Pack. This is of conventional design, employing a full wave rectifier circuit with choke-capacitance smoothing. The mains transformer permits the instrument to be operated from 100V to 150V or 200V to 250V supplies, 40-100 c/s; the tap panel is accessible at the front panel.

2. OPERATION.

2.1. Installation. The instrument is normally dispatched, unless otherwise specified, with all valves, etc., in their holders and with the mains transformer adjusted for operation from a 230 volt, 40-100 c/s supply. For other voltages between 200V and 250V, open the window on the front panel and adjust the tappings accordingly. For voltages between 100V and 150V, unscrew the tapping plugs, reverse the tapping plate and switch setting; then screw in the tapping plugs as required.

Connect the SUPPLY lead, switch ON the SUPPLY, note that the pilot lamp glows, and allow time for the valves to warm up and stabilise before setting up the instrument.

2.2. Setting Up and Measurements.

(1) Switch to SET DEVIATION and check that the meter deflects to the SET DEVIATION mark; if not, uncover the SET DEVIATION preset control and adjust accordingly.

(2) Switch to TUNE, connect the source under test to the Terminating Unit at the input end of the input cable and plug the connector into the appropriate INPUT socket. The minimum input required is about 55mV at the LOW LEVEL socket and of the order of 750mV at the HIGH LEVEL; use the latter when possible, to avoid overloading. The maximum input at the HIGH LEVEL inlet should not exceed 8 volts. Note: The Terminating Unit does not contain any attenuator or matching pad as it is simply a terminal block. The input impedance at either inlet is approximately 75Ω.

Set the oscillator FREQUENCY RANGE selector and the tuning dial on its right to the frequency of the source, then slowly tune through the signal carrier, in the case of high frequencies using the incremental frequency control in the centre of the dial for fine adjustments. Note: The frequency calibration is correct when the indicator of the incremental knob is at the top.

It will be found that two maxima are indicated by the meter - one below and one above the carrier frequency; these are separated by a central point of zero response at which the carrier and oscillator are in tune and produce zero beat. Working from this central point, shift the frequency control slowly towards either of the adjacent maxima (above

the signal frequency for positive deviation - that is deviation towards a higher frequency - or below for negative deviation) and continue until the meter reads at the TUNE mark. Critical tuning is necessary only when wide deviations are to be measured.

WARNING: Do not continue to the peak and then come down on the other side of it to set to the standardising mark. It is essential that the setting up should be done on the side adjacent to the zero beat point between the two maxima.

(2) Switch to CHECK INPUT and observe that the meter deflects to above the TUNE mark. If it is below the mark, increase the input accordingly; then recheck operation (1).

When the input is adequate - the working limits lie between about 50 mV and 750 mV for the LOW LEVEL input socket - varying the level of the incoming signal without varying its frequency should not change the meter indication when it has been set to TUNE as in (1).

(3) Switch to the required DEVIATION RANGE, read the meter and apply the appropriate range factors:- multiply by 3, multiply by 1 or divide by 5, as engraved on the panel.

2.3. Use of L.F. Output Terminals and Phones Jack. These outlets are provided so that the modulation may be checked aurally or visually by connecting telephones, a c.r.o., a distortion factor meter or a wave analyser to the output of the l.f. amplifier. To avoid disturbing the circuit - and hence the accuracy of the deviation indication - both jack and terminals are fed via an independent buffer stage; the output impedance is of the order of 600Ω and the level approximately 1 volt at f.s.d. on the meter.

3. MAINTENANCE.

Valves etc. These are listed on Page One under SCHEDULE OF PARTS SUPPLIED and may be replaced without materially affecting the operation of the instrument, although in certain instances it may be necessary to readjust the preset controls as described below. In any case, all diode and l.f. amplifier valves should be aged for at least 100 hours.

Operating Voltages. The heater voltages should be within the limits 6.0 - 6.6 V a.c. The main h.t. voltage after smoothing should lie between the limits of 235 - 255V d.c.

Using a high resistance voltmeter, the operating potentials at the valves should be of the following orders:-

Valve No.	Anode	Screen	Cathode.
1	85 - 130	110 - 130	-
3	220 - 240	220 - 240	1.6 - 2.1
4	25 - 35	17 - 33	0.12- 0.35
5	30 - 50	75 - 100	0.9 - 1.2
6	125 - 155	85 - 125	0.9 - 1.3

Valve No.	Anode	Screen	Cathode.
7	180 - 210	235 - 255	1.9 - 2.6
11	9 - 16	9 - 11	0.18- 0.27
12	95 - 115	90 - 95	1.1 - 1.5
14	235 - 255	-	33 - 42
15	235 - 255	-	33 - 42

Preset Controls. The two preset controls RV2 and RV3 at the rear of the chassis deck are locked by means of the locking-bar which spans them; normally they should on no account be disturbed as both have been carefully adjusted during final tests.

The preset potentiometer RV2 provides a variable central earthing point for the heater circuit of V11 and is not likely to require adjustment unless excessive supply frequency hum is present after fitting a replacement valve.

The variable preset resistor RV3 is used in the initial setting up of the frequency deviation calibration, in the following manner:-

(1) A signal of accurately known deviation - preferably determined by the "disappearing carrier" method - is applied and preset RV7 (SET DEVIATION) adjusted to give the correct deviation indication on the meter.

(2) With the Switch at SET DEVIATION, preset RV3 is adjusted to bring the meter to the SET DEVIATION mark. Preset RV3 is then locked.

RCONI INSTRUMENTS LTD					TITLE	FUNCTIONAL DIAGRAM F.M. DEVIATION METER.			
N	J.F.G	CHKD		APP'D		STOCK LIST	TF. 934	DRG No	TBI 20390
	2-7-50								

MARCONI INSTRUMENTS LTD. ST ALBANS. ENGLAND.

DIAG Nº 5441.

TEST SET DEVIATION. T.F.934.

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